Low Temperature Thermal Desorption (VAC*TRAX)

Developer: Rust Federal Services, Inc.
Contract Number: DE-AC21-92MC29105
Crosscutting Area: N/A

Mixed Waste FOCUS AREA

Problem:

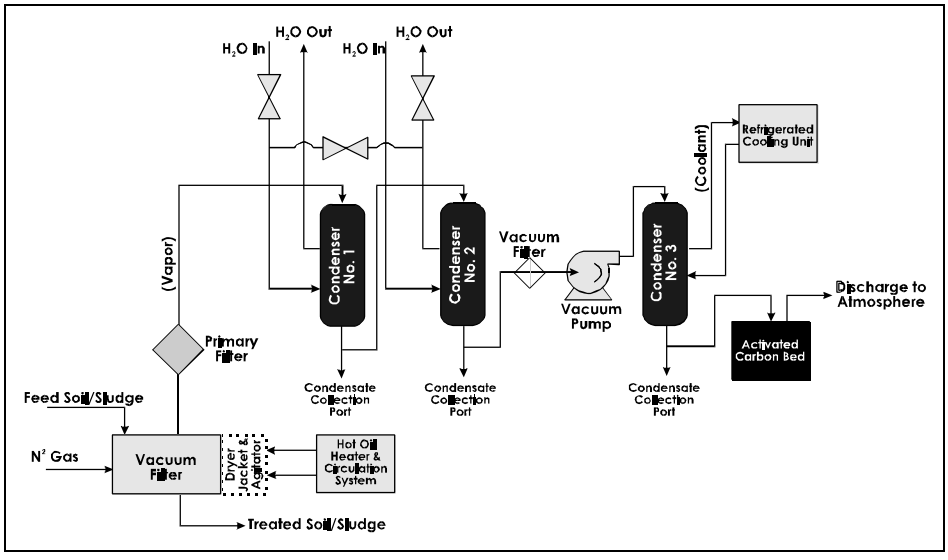
Thermal separation systems are needed to treat organically contaminated soils, sediments and sludges at sites with small soil volumes (200 - 2000 m^3). Existing, demonstrated thermal separation systems have high mobilization, operation, and demobilization costs, which significantly impact the processing costs for sites with smaller feed quantities.

Solution:

Develop a thermal separation system designed to be relatively inexpensive to mobilize, demobilize and operate. VAC*TRAX is a process for separating organic contaminants from soils, with applicability to both mixed and unmixed streams. The process generates product streams that are amenable to further treatment and/or disposal through conventional methods.

Benefits:

- Treats organically contaminated soils, sludges, and sediments
- Remediation of sites that are contaminated with Resource Conservation and Recovery Act/Toxic Substance Control Act (RCRA/TSCA) organics
- Mobile system
- Uses existing process equipment with minimal custom-fabricated equipment
- Flexible in terms of range of variation of the processing parameters (concentration of contaminants)



Technology:

The main component of the VAC*TRAX system is a stirred batch vacuum reactor (dryer), a jacketed vessel with a total volume of 53.8 liters and a working volume of 31.3 liters. Working capacity is around 50kg, if the soil density is about 1.6 kg/liter. The agitator is jacketed, providing an area of heat transfer of 1.4 m^2 in the dryer. The thermal fluid in the jacket is heated by a vendor packaged, 24 kW electrically powered hot oil unit. A particulate filter is attached to the vapor outlet of the dryer in order to separate the solids from the vapors, thereby keeping the solids in the dryer and reducing any carry-over.

After passing through the particulate filter, the vapor phase enters the vapor handling system (VHS). The VHS consists of three condensers, a

vacuum pump, and a secondary particulate filter. All three condensers have approximately 0.7 square meters of heat transfer area. The vapor phase enters the first condenser, where it is cooled by cold tap water, then continues on to the second condenser where it is once again cooled by cold tap water. The cooling water for condensers 1 and 2 is plumbed such that it can flow either in series or in parallel.

The vapor, on the other hand, can only flow in a series path. The condensate from each condenser can be collected and sampled separately. After passing through condenser 2, the vapor phase enters another particulate filter before entering the vacuum pump. Condenser 3 is placed directly after the vacuum pump. The coolant in this condenser is a chilled 50% glycol/water solution. Any vapor leaving condenser 3 passes through a carbon-bed filter before being discharged into the atmosphere.

Sufficient monitoring instruments are placed at various points on the systems to allow energy and mass balances to be determined. Thermocouples are installed in the dryer, before and after each condenser, and at the coolant inlets and outlets on the condenser. Flowmeters have been placed such that nitrogen flow into the system can be set and measured and coolant flow into each condenser can be set and measured. Pressure/vacuum gauges are also placed strategically around the system. Phase I of the project involved design of the test system, surrogate sample testing, and Department of Energy (DOE) site mixed waste testing. Phase II involved the preparation of a conceptual design and detailed cost estimate for a full-scale VAC*TRAX system.

Project Conclusion:

This successful contract was concluded in December 1995 after the second phase because it was determined that further demonstration was not necessary. The technology was proven both within the contract as well as with other DOE sponsored activities.

It has been reported that the Grand Junction facility (using Geotech, a Rust subsidiary) has designed a system sized for their site, and system fabrication was scheduled in FY 97. Since Rust is no longer the site contractor, the fabrication is now somewhat questionable.

A total of seven RCRA and/or TSCA tests were performed, in addition to four tests on RCRA mixed waste. Contaminants of concern included, but were not limited to: tetrachloroethylene, bis(2-ethylhexyl)phosphate, pentachlorophenol, and PCBs. Treatment goals were met or exceeded in all cases. Noteworthy was a tetrachloroethylene removal efficiency exceeding 99.99% and PCB reduction from an initial concentration of 990 ppm to a final concentration of less than 1 ppm. Surrogate testing and later testing for other DOE sites demonstrated that radionuclides were left in the solid waste for further disposal.

Contacts:

Rust Federal Services has extensive experience with thermal desorption technologies, and is applying that experience to address the DOE's needs in environmental restoration and waste management. For information on this project, the contractor contact is:

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DOE's Federal Energy Technology Center supports the Environmental Management - Office of Science and Technology by contracting the research and development of new technologies for waste site characterization and cleanup. For information regarding this project, the DOE contact is:

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